



Pharmacognostical Studies on *Cnidoscolus chayamansa* Leaves

Kulathuran Pillai K^{*1}, Narayanan N², Chidambaranathan N³, Jegan N³

¹Periyar Maniammai University, Thanjavur, Tamil Nadu, India.

²Jaya College of Pharmacy, Thiruninravur, Chennai, India.

³K.M. College of Pharmacy, Madurai, Tamil Nadu, India.

*Corresponding author's E-mail: kkpillai_pillai@yahoo.co.in

Accepted on: 31-07-2014; Finalized on: 30-09-2014.

ABSTRACT

The tree spinach *Cnidoscolus chayamansa* Mc Vaugh called "Chaya" belonging to the family Euphorbiaceae. The plant is an attractive shrub 3 to 5m tall. The leaves are broad and may consist of 3 or more lobes with fleshy petioles. The white colored flowers which are usually borne on cyme branched inflorescences, may contain 3-forked arrangement in which the pistillate flowers are located on the basal fork. Even though this plant has gained scientific importance recently, there is a need for the pharmacognostical standardization. Therefore in the present studies the leaf part of the plant was subjected to various microscopical and physical evaluations. In the microscopical studies like leaf constants, powder microscopy and physical evaluation like ash values and extractive values were studied. The different pharmacognostical constants were obtained which could help in the development of a suitable monograph for the plant.

Keywords: *Cnidoscolus chayamansa*, Fluorescences analysis, Herbs, Leaf constants, Proximate analysis.

INTRODUCTION

Plants have been associated with the health of mankind from time immemorial. In the past sickness was viewed as a punishment from the god's and hence was treated with prayers and rituals that included what may have been considered "magic portion" prepared from local herbs. The tree spinach (*Cnidoscolus chayamansa* Mc Vaugh, Euphorbiaceae), called "Chaya" in south Texas, is popular in Mexico and central America and has been introduced into the United states (Mainly south Texas and Florida) and now presently available in and around southern part of India, for potential uses as a leafy vegetable and/or as a medicinal plant¹ The leafy vegetable was consumed by Mayan Indians and is traditionally incorporated in as salad an regional dishes.² Chaya consumption has also become popular among Hispanic population in southern Texas Florida.³ The plant is an attractive shrub 3 to 5 m. tall. It shows great adaptability to milder climates and can be found growing in northern latitudes, under dryer environments and in different solid.⁴ The leaves are broad and may consist of 3 or more lobes with fleshy petioles. The white colored flowers which are usually borne on cyme branched inflorescences, may contain 3-forked arrangement in which the pistillate flowers are located on the basal fork. The staminate flowers are expanded distally from the base of the lobes. Mature seeds and fruits are rare and unknown.⁵ The young shoots and tender leaves of Chaya are cooked and eaten like spinach. They comprises a part of the stable diet and are the main dietary source of leafy vegetable for the indigenous people of Yucatan Peninsula of Mexico and Kekchi people of Alte Verapaz in Guatemala.^{6,7} The edible parts of Chaya plant which taste like spinach when cooked, provide important nutritional

sources for proteins, vitamins (A and C), minerals (calcium, iron, phosphorus), niacin, riboflavin and thiamine among populations that cannot afford expensive foods rich in these nutrients.⁸ Chaya traditionally has been recommended for a number of ailments including diabetes, obesity, kidney stones, hemorrhoids, acne and eye problems.⁹ Chaya shoots and leafs have been taken as a laxative, diuretic, circulation stimulant, to improve digestion, to stimulate lactation, and to harden the finger nails.¹⁰



Figure 1: Morphology of *Cnidoscolus chayamansa*

MATERIALS AND METHODS

The leaves of *C.chayamansa* were collected from in and around Kanyakumari district, Tamilnadu. The plant material was taxonomically identified and authenticated by Mr.V.Chelladurai, research officer (Botany) CCRAS Govt. of India (Rtd), Tirunelveli, Tamilnadu and the voucher specimen (KMCP/KKP/CC-0288) were retained in the institute for future reference. Preparation of herbarium was submitted and the plant was certified as *Cnidoscolus chayamansa* Mc Vaugh, Family- Euphorbiaceae.



Chemicals and reagents

All the chemicals and reagents used were of laboratory grade.

Microscopical studies¹¹⁻¹⁴

Transverse section and cross section of *Cnidoscolus chayamansa* leaf

Free hand sectioning was done for fresh leaf to obtain a thin section. Phloroglucinol and hydrochloric acid in the ratio 1:1 was used as a stain and mounted on a glass slide and focused under a microscope.

Powder microscopy

The leaf powder of *Cnidoscolus chayamansa* was soaked in distilled water separately. The soaked powders were boiled with chloral hydrate solution for few minutes. Powdered materials were cleaned with sodium hydroxide and mounted in glycerine medium, after staining with phloroglucinol, hydrochloric acid and iodine solution. The diagnostic characters were identified by microscope using normal bright field and reported. From the above observation, crystals, starch grains and lignified cells, polarized light was employed, under polarized light appear bright against background.

Determination of *Cnidoscolus chayamansa* leaf constants

The different parameters like stomatal number, stomatal index, vein islet number and vein termination number was determined as per standard procedure.

Fluorescence analysis¹⁵

Powdered leaf were subjected to analysis under day light, ultra violet light (254,366 nm) after treatment with various chemical and organic reagents like ethanol, 50% sulphuric acid, 10% sodium hydroxide and dilute hydrochloric acid.

Physicochemical Studies

Physicochemical parameters were determined as per guidelines of WHO.¹⁶ loss on drying, Total ash value, acid insoluble ash, water soluble ash, sulphated ash, alcohol soluble extractive value, ether soluble extractive value and water soluble extractive value were determined by taking the powdered leaf.^{17,18}

RESULTS AND DISCUSSION

Transverse section of *Cnidoscolus chayamansa* leaf

Microscopic observation revealed that the leaf provided with the paracytic type of stomata. There are more number of stomata are present (43.00 ± 1.50) in the lower surface of the leaf whereas, less numbers are present (2.60 ± 0.50) on the upper surface. The stomata measures about 23.75 ± 0.00 μm in length and 15.75 ± 1.25 μm in breadth. Transverse section of the leaf revealed that the epidermal cells consist of straight anticlinal walls. Beneath every epidermal cell there are about 2.78 ± 0.20 palisade

parenchyma cells are present. Below the palisade parenchyma there are loosely arranged spongy parenchyma cells are present. Larger vascular bundle cells are present in the midrib region of the leaf below the vascular bundles lactiferous cells are present in half lunar manner. The quantitative leaf parameters are listed in Table 1.

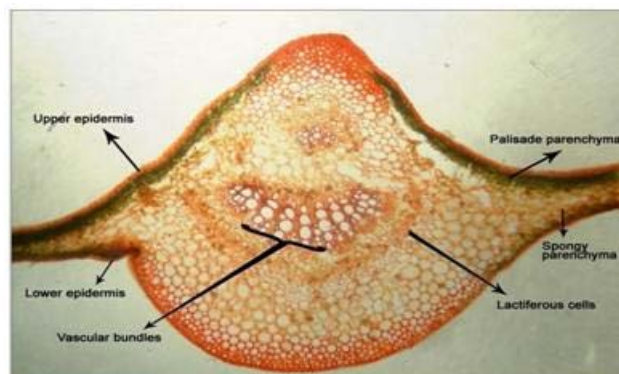


Figure 2: Microscopic T.S. of *Cnidoscolus chayamansa* leaf

Table 1: Leaf constants of *Cnidoscolus chayamansa*

Parameters	Range	Mean
Palisade ratio	2.31 - 3.24	2.78 \pm 0.20
Stomata number Upper surface	0.42 - 4.77	2.60 \pm 0.50
Stomata number lower surface	33.57 - 52.42	43.00 \pm 1.50
Stomatal index upper surface	0.15 - 1.84	1.00 \pm 0.20
Stomatal index lower surface	25.33 - 37.62	31.48 \pm 0.02
Epidermal cells Upper surface	226.18 - 288.41	257.30 \pm 8.00
Epidermal cells lower surface	30.97 - 68.83	95.80 \pm 3.00
Stomata length	21.04 - 26.45	23.75 \pm 0.00
Stomata Breadth	13.69 - 17.80	15.75 \pm 1.25
Vein islet number	60.49 - 100.10	80.30 \pm 6.26
Vein termination number	70.08 - 92.91	81.50 \pm 3.61

*Stomatal no, Epidermal cells, vein islet, termination counts per 1 mm square area (1mm²); Stomatal length in μm .

Powder microscopy of *Cnidoscolus chayamansa* leaf

The powder microscopy of leaf was done and the data mentioned below is correlated with Figure 3.

- Epidermis:** The cells of epidermis of leaf are thin walled, sinuous and showing anisocytic type stomata.
- Stomata:** Anisocytic or cruciferous type of stomata surrounded by subsidiary cells of wavy walled.
- Trichomes:** The covering trichomes, which are slightly curved and usually unicellular, the walls are thick.

4. **Vessels:** Lignified annular thickened, bordered pitted vessels.
5. **Crystals:** The calcium oxalate crystals which are fairly abundant, they are found scattered or they are usually in the form of single or twinned prisms but are very irregular in shape.
6. **Lamina:** The fragments of lamina in sectional view showing the tubular epidermal cells with striated cuticle, the single thin walled palisade cell and the irregular cells of the spongy Mesophyll.

Cross section of *Cnidoscolus chayamansa* leaf

C.S. of *Cnidoscolus chayamansa* shown in figure 4 indicates the presence of upper epidermis, stomata, trichomes, upper palisade, collenchymas, spongy parenchyma, xylem, phloem and lower epidermis.

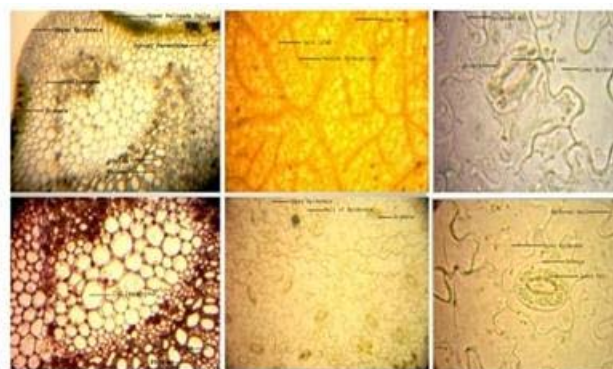


Figure 4: Microscopic Cross section of *Cnidoscolus chayamansa* leaf

Proximate analysis

The results obtained for the leaf are tabulated in Table 3.

Table 3: Proximate analysis of *Cnidoscolus chayamansa* leaf

Parameters	Values (%w/w) ± S.D
Loss on drying	5.21±0.02
Total ash	4.08±0.35
Acid insoluble ash	1.21±0.10
Water-soluble ash	0.55±0.04
Sulphated ash	5.21± 0.05
Alcohol soluble extractive value	12.0±0.8
Ether soluble extractive value	10.2±0.12
Water soluble extractive value	8.3± 0.02

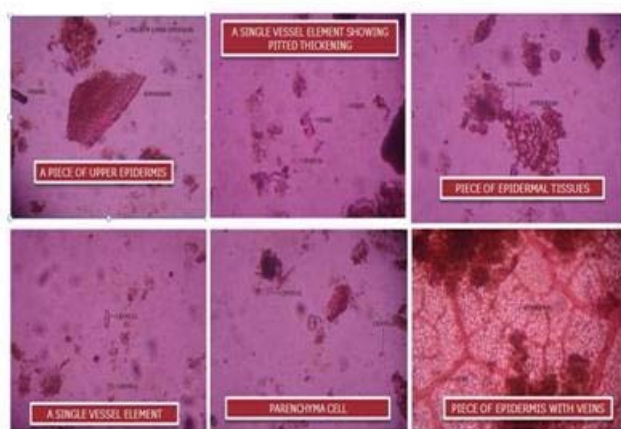


Figure 3: Powder microscopy of *Cnidoscolus chayamansa* leaf

Table 2: Fluorescence analysis of leaf powder of *Cnidoscolus chayamansa*

Treatment	Daylight	UV light 254 nm	UV light 366nm
Powder	Green	Dark Green	Pale Green
Powder treated with distilled water	Green	Dark Green	Dark green
Powder + CHCl ₃	Green	Dark Green	Blackish green
Powder + 1N HCL	Green	Green	Green
Powder + 50% HNO ₃	Pale Green	Pale Green	Yellowish Green
Powder + 50% H ₂ SO ₄	Light Green	Colourless	Pale Green
Powder + 1N NaoH in Ethanol	Pale green	Buff Green	Pale Green

Fluorescence analysis

The powder leaf of *Cnidoscolus chayamansa* was examined under day light and ultraviolet as shown in table 2.

CONCLUSION

Cnidoscolus chayamansa is used for the treatment of various physiological conditions. But so far the plant has not been Pharmacognostically evaluated. The detailed pharmacognostical evaluation like microscopical studies such as determination of leaf constants, transverse section, cross section, Powder microscopy, fluorescence analysis, proximate analysis and physical constants such as ash value, extractive value which would be a useful for compilation of a suitable monograph for its proper identification and will help in establishing some biological indices. For easier identification of powdered crude drugs UV estimation for leaf powder will be helpful. The Pharmacognostic constants for the leaves of this plant, the diagnostic microscopic features and the numerical standards reported in this work could be useful for the compilation of a suitable monograph for its proper identification and future studies.

REFERENCES

1. Breckon GJ, Studies in *Cnidoscolus* (Euphorbiaceae), Brittonia, 31, 1979, 125-148.
2. Martin FW, Telek L, Ruberte R, Some tropical leaves as feasible sources of dietary protein, J Agric University of Puerto Rico, 61, 1977, 32-40.

3. Kuti JO, Kuti HO, Proximate composition and mineral content of two edible species of *Cnidoscolus* (tree spinach), *Plant Food for Human Nutrition*, 53(4), 1999, 275-283.
4. Martin FW, R Ruberte, Chaya, *Cnidoscolus chayamansa* includes composition and nutritional value, culture in Puerto Rico, In: *Vegetables of hot humid tropics*, USDA, ARS. New Orleans, LA, 1978.
5. McVaugh R, The genus *Cnidoscolus*: generic limits and intrageneric groups, *Bul. Torrey Bot. Club*, 71, 1944, 457-474.
6. Harris RS, HE Munsell, *Edible plants of Central America*, *J. Home Econ.*, 42, 1950, 629-631.
7. Booth S, R Bressani, T Johns, Nutrient content of selected indigenous leafy vegetable consumed by Kekchi people of Alta Verapaz, Guatemala, *J. Food Compos. Anal.*, 5, 1992, 25-34.
8. YH Yang, *Tropical Home Gardens as Nutritional Intervention*, In, G. E. Inglett and G. Charalambous (Eds.), *Tropical Food Chemistry and Nutrition*, Academic Press, New York, 1979, 417-436.
9. Diaz-Bolio J. Chaya, (*Cnidoscolus chayamansa*, Euphorbiaceae), a marvellous food (in spanish), *Tierra*, 30, 1975, 407-408, 427-428.
10. Rowe L, *Plant guard's secret of good health*, Valley Morning Star, 1994, A1, A12.
11. Khandelwal KR, *Practical Pharmacognosy*, 1st edition, Nirali prakashan, Pune, 2005, 27-35.
12. Kokate CK, *Practical Pharmacognosy*, 4th edition, Vallabh Prakashan, New Delhi, 2003, 122-126.
13. Biren N. Shah, Nayak BS, *Experimental Pharmacognosy*, S.Vikas & Co, Jalandhar, First edition, April 2008, 2/15 – 2/30.
14. Betty P. Jackson, Derek W. Snowdon, *Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices*, CBS Publishers and Distributors (P) Ltd, New Delhi, First Indian Reprint 1992.
15. Kokate CK, *Text book of Pharmacognosy*, 4th edition, Vallabh Prakashan, New Delhi, 1994, 112-120.
16. WHO, *Quality control method for medicinal plant materials*, World Health Organization, Geneva, 2003, 311-314.
17. Anonymous, *Pharmacopoeia of India*, Government of India, Ministry of Health, Controller of publication, New Delhi, 4(2), 1996, 53–55.
18. Anonymous, *The Ayurvedic Pharmacopoeia Of India*, New Delhi Department Of Ayush, Ministry Of Health And Family Welfare, Government Of India, 2 edition, 4, 2009, 70 –72.

Source of Support: Nil, Conflict of Interest: None.

